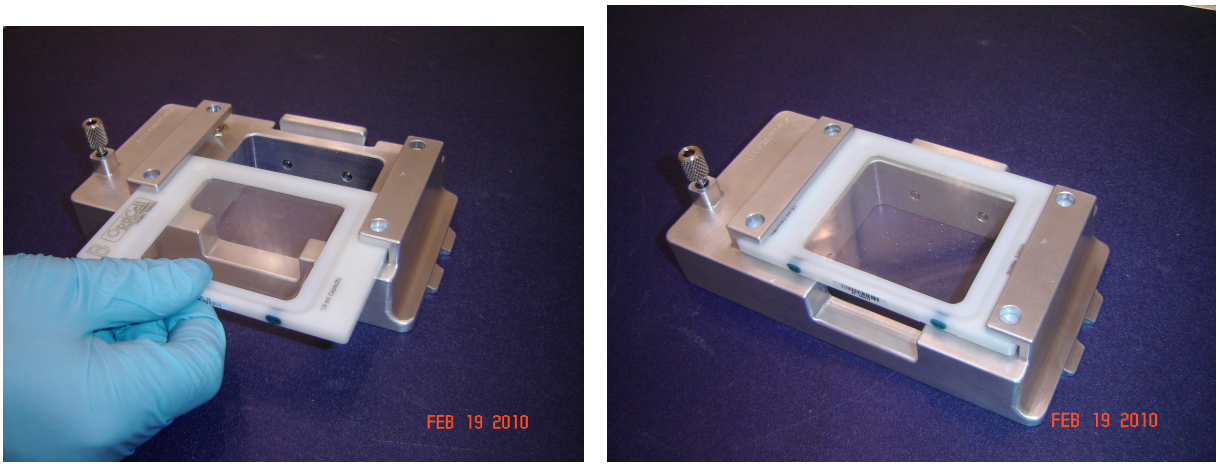
ISS and Human Research Project Office Highlights
February 26, 2010

ISS Research Program

The Engineering Model (EM) of the first biological sample holder for the (ISS) Light Microscopy Module (LMM) has been assembled. The experiment demonstration LMM-Bio is scheduled to launch on ULF-6 (presently 7/29/10). LMM-Bio will test the capabilities of LMM to image and collect science data on live (moving) samples. The first test will be with c-elegans a small wormlike animal commonly used in biological testing. The LMM-Bio sample holder integrates the existing mounting and software used for the first LMM experiment (Constrained Vapor Bubble CVB) with the (previously flown) Opt-Cell containment cell. LMM is scheduled to begin checkout and powered operations in the late evening and early morning of March 4 and 5. LMM-Bio is scheduled to operate in August or early September. The data will be used to assist in the development of Biological experiment that fully utilizes LMM's capability on ISS. (POC: MAH/Ronald Sicker, (216) 433-6498)



Engineering Model of biological sample holder for LMM

FLEX-2 Kickoff Meeting for CDR held.

A Kickoff meeting for the Flames Extinguishment Experiment=2 (FLEX-2) Critical Design Review (CDR) was held on February 19, 2010. The Project Team gave a brief overview of the project to the CDR Board. The Board Chairman solicited the Board members for comments and asked for certain documents to be included in the eRoom. The documents for review by the CDR board have been uploaded to the CDR folder in the CIR Experiments eRoom. The CDR is to take place on 25 February 25. 2010. (POC: MAH/J. Mark Hickman, (216) 977-7105)

Cameras ordered for Advanced Combustion via Microgravity Experiments (ACME)

Two ProSilica cameras have been ordered for testing with the breadboard system. One of the two cameras has a alternate (lower) gain setting that may satisfy certain science requirements, while most of the requirements need a higher gain and are not bothered by an increased signal to noise ratio. Results of the testing will determine the type and number of cameras to manifest for flight operations. (POC: MAH/J. Mark Hickman, (216) 977-7105)

Ground Testing resulted in good samples for Smoke Aerosol Measurement Experiment-Reflight (SAME-R)
Ground testing over the last week resulted in good samples from the B list, which included particle images. Testing is in preparation for the System Requirements and Design Review (SR/DR), to be scheduled in mid to late March. The SAR reviews are tentatively scheduled for late May and early June. (POC: MAH/J. Mark Hickman, (216) 977-7105)

ISS Program Scientist interviewed by BBC regarding CFE
A British Broadcasting Corporation (BBC) interview with International Space Station (ISS) Scientist Dr. Julie Robinson asked 'why science in space' focused on the Capillary Flow Experiment (CFE) as a major contributor to fundamental physical science knowledge. Dr. Julie Robinson is the Program Scientist for the ISS at NASA Johnson Space Center. She serves as the chief scientist for the ISS Program, representing all ISS research inside and outside the agency. She provides recommendations regarding research on the ISS to the ISS Program Manager and the Space Operations and Exploration Systems Mission Directorates at NASA Headquarters.

Technologies for liquid management in space (0-g) use capillary forces to position and transport liquids, since hydrostatic pressure is absent which gives the liquid a defined surface and enables easy withdrawal from the tank bottom. The effect of capillary forces is limited on earth to a few millimeters, but in space these forces affect free surfaces that extend over meters. For the application of capillary channels in propellant tanks of spacecrafts, design knowledge of these limitations is a requirement, predicated with a bubble free liquid restriction prior to entering the thrusters. The current design of spacecraft fuel tanks relies on an additional reservoir to prevent the ingestion of gas into the engines during firing.

The CFE-2 Interior Corner Flow (ICF) test vessels seek to at least determine: (1) the rates of 3-D imbibition of wetting fluids in containers of systematically increasing complexity, (2) the dependence of model dynamical boundary conditions as a function of geometry, and (3) the performance of such devices as passive phase separators by converting bubbly flows to separated continuous gas and liquid inventories. A slow migration or secondary imbibition of fluid across the chamber driven by the combined effects of capillary forces and global changes in container dimensions benefits from the long duration low-g environment of the ISS.
These test cells employ characteristic dimensions of current spacecraft equipment that are approximately two orders of magnitude larger than similar systems on Earth. This choice significantly alters the time scales of the flow and dramatically increases (104-fold) the volume of fluid involved as well as the effective accuracy of the test cell geometry. The experiments are designed to benchmark the analytical techniques developed to predict such flows. The benchmarked theory can then be used to design and analyze capillary devices for positioning liquids passively in containers in low-g environments by careful control over container geometry. The devices are used to perform passive phase separation operations as in the case of tapered screen galleries for bubble-free collection and positioning of fuels for satellites, an important and outstanding problem for propellant, coolant, or water management aboard spacecraft. http://www.bbc.co.uk/blogs/thereporters/jonathanamos/2010/02/post-shuttle.shtml
(POC: MAHO/Donna Bohman (216) 433-8860)

Encyclopedia of Aerospace Engineering Chapter
A chapter entitled "Materials for Space Applications" has been submitted for publication in the *Encyclopedia of Aerospace Engineering*. The chapter will be published as one of seven chapters under "Materials for Space Applications," which is under the general category "Materials Technology." The article reviews most major materials spaceflight experiments along with some of the lessons learned from the experiments, and how the experiment results have influenced materials use and selection. Some of the experiments reviewed include: experiments on Skylab; experiments on the Russian Space Station Mir; Shuttle fight experiments, such as the Evaluation of Oxygen Interactions with Materials III (EOIM III); long duration free-flyer experiments including the Long Duration Exposure Facility (LDEF), the European Retrievable Carrier (EURECA), and the Exposed Facility Flyer Unit on the Space Flyer Unit (SFU/EFFU)); and, long-duration experiments on the International Space Station (ISS) including the Materials International Space Station Experiment (MISSE), the Micro-Particle Capturer and Space Environment Exposure Device (MPAC&SEED) experiments, and the Materials Exposure and Degradation Experiment (MEDET). The *Encyclopedia of Aerospace Engineering* will include articles written by an international team of authors and will cover fundamental topics in mechanical, electrical and chemical engineering through to areas of increasing importance such as advanced materials, digital technology and environmental science. The encyclopedia will be published by Wiley and is planned for publication in 2010 in both online and print formats. Information on the encyclopedia can be found at: http://eae.wiley.co.uk/view/0/index.html. This work is supported by the ISS Research Project (POC: RES/Kim de Groh, (216) 433-2297)

Human Research Program

JSC Flight Surgeon visits GRC.
On Tuesday, February 16, Dr. Douglas Hamilton, a Johnson Space Center (JSC) flight surgeon, visited the Glenn Research Center (GRC) to learn more about GRC technologies that can support medical operations.

Dr. Rafat Ansari demonstrated and discussed hardware to quantify blood pressure/flow in the eye as a possible way to provide on-orbit diagnoses of papilledema, a condition from which many long duration astronauts suffer, and one that does not quickly resolve upon return to earth. In order to treat the disease, flight surgeons need to know more about its microgravity onset; hence the need for hardware like Dr. Ansari's.

Dr. Dan Dietrich presented the Portable Unit for Metabolic Analysis (PUMA), which quantifies exhaled gas content, volume, and temperature. In addition to using PUMA during microgravity exercise, Dr. Hamilton envisioned using PUMA as part of emergency treatment regimens, and as a way to quantify the effects of oxygen pre-breathe protocols prior to EVA.

Mr. Alan Chmiel of ZIN Technologies presented the BioWATCH wireless data collection, storage, and transmission hardware. Developed under GRC SBIR awards, BioWATCH is a candidate to replace aging ISS data collection hardware. Dr. Hamilton noted that some of the ZIN devices that work with BioWATCH were some of the most advanced that he has seen.

Glenn Human Research Program personnel will follow up this visit to insure that NASA utilizes Glenn technology to reduce human risks associated with long duration spaceflight.. (POC: MAH/DeVon Griffin, (216) 433-8109)